OUR BOOK SHELF

Die Weich- und Schaltiere gemeinfasslich Dargestellt. Von Prof. Ed. von Martens. (Leipzig: G. Feytag; Prag: F. Tempsky, 1883.)

"CONCHOLOGY is ris!" was the pithy remark of the lamented Edward Forbes, made in his cheery way about forty years ago, when Mr. James Smith of Jordan Hill directed his attention to the arctic nature of some fossil shells in the Clyde district. Capt. Brown, however, had previously but unconsciously published the same hypothesis, which has been lately confirmed and extended by the discoveries of Messrs. Steele and Scott at Glasgow. Since the above remark was made by Forbes the study of the Mollusca has in a general point of view marvellously increased and become popularised by innumerable publications. We have now no fewer than six periodical works on the subject, English, French, Belgian, German, Italian, and American, besides four most useful manuals in English, French, German, and American. The German and latest manual, now before me, has been written by an experienced conchologist whose father (Georg von Martens) was favourably known to science nearly sixty years ago by his "Reise nach Venedig." The present author may therefore be considered an hereditary naturalist.

The manual of Prof. von Martens differs from that of Dr. Paul Fischer ("Manuel de Conchyliologie") which is in course of publication, as well as from Woodward's "Manual," in its plan and popular mode of treatment, although all these works are equally good. The present treatise on the soft or naked and shelly Mollusks forms a small octavo handbook of 327 pages, and is illustrated by 205 figures. The principal contents of the work are as follows:—

(1) Names and position in zoology; (2) The shell in general; (3) Organic structure of the Mollusca; (4) Cephalopods; (5) Univalve shells, Nudibranchs, Heteropoda, Pteropoda, and Solenoconchia; (6) Bivalves; (7) Habitat and geographical distribution; (8) Enemies and use of the Mollusca. The illustrations are excellent; they are not arranged in plates, as in the manuals of Woodward and Fischer, but are dispersed throughout the work in their appropriate places by way of explanation. This is in some respects an improvement, although it causes an unnecessary repetition of the same figures. For instance *Margaritana margaritifera* (why not *Unio margaritifer?*) is figured three times in pp. 196, 221, and 311.

The curious varieties or monstrosities of *Planorbis multiformis*, a tertiary shell from Steinheim, are well shown in Fig. 128. I am very glad to see that the author is by no means addicted to an excessive multiplication of genera and species, which is the normal failing of so many Continental conchologists, especially in the land and freshwater shells. In the Pteropoda he has rightly adopted Pallas's generic name *Clione* (1767-1774) for *C. borealis*, instead of Müller's name *Clio* (1776), which Fischer has used in the reverse sense. *Clio* of Linné (founded on Browne's genus and Jamaican species) is wrongly represented in the manuals of Fischer and von Martens by *Cleodora* of Lamarck. As no review or notice of any book is regarded as complete or satisfactory without a dash of criticism, however slight, I would venture to suggest a few corrigenda for the next edition. It is impossible to distinguish *Helix hortensis* from *H. nemoralis*, except as a variety, the former being more northern and the latter more southern in geographical distribution. *Hyalæa* of Lamarck (1810) ought to be *Cavolina* of Gioeni (1783) and Abildgaard (1791), not of Bruguière (1792); *Loripes* is not a synonym of *Lucina*, but a distinct genus, and *Sphærium* is a much older name than *Cyclas*. But I make these few remarks more for the consideration of the author than from any pretence on my part to be a judge. I can heartily and conscientiously recommend this manual not only to the scientific but to the ordinary class of readers. J. GWYN JEFFREYS

Notes on Qualitative Analysis, Concise and Explanatory. By H. G. H. Fenton. (Cambridge University Press, 1883.)

THESE are ordinary tables of reactions of the "more common metals and acids," and also of some of the "more common organic bodies." The organic bodies include carbohydrates and a few alkaloids.

It is very strange that the farce of common and rare elements is still maintained in nearly all the tables and books on qualitative analysis. Surely such elements as titanium and tungsten and molybdenum and selenium or lithium are common enough, at any rate in laboratories, to have a place given to them in analysis books, not to mention thallium, glucinum, and cerium, which do occur in minerals, to the no small mystification of the poor student crammed up with tables of analyses of "common metals." There are rather too many empty pages in these "Notes," and the size is inconveniently large for working with on a laboratory bench.

Practical Chemistry, with Notes and Questions on Theoretical Chemistry. By William Ripper, Science Master, Sheffield Board School. (London: Isbister, 1883.)

THESE notes and questions, mostly questions, have been, as the author explains, compiled to prepare students and teachers for the examinations of the Science and Art Department. It is to be regretted that such books are required, for although, as the author states in his preface, the arrangement may have been very successful in "passing" students, it is questionable whether the information and knowledge obtained are of such a nature as to be valuable afterwards. The book is well adapted for its purpose, that of cramming.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts, No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Matter of Space

WILL you permit me to express my thanks to Prof. Herschel for his flattering review of my paper on "The Matter of Space," in NATURE, vol. xxvii. p. 349? It is certainly gratifying to find that the views which I deduced from the ordinary relations of moving matter are confirmed by the results of mathematical analysis, and it is a source of satisfaction to me to have called forth such a studied and thorough treatment of the subject as Prof. Herschel has given it. I cannot but retain my view of the unity in character of all substance, to which he objects, yet in that respect our opinions diverge but slightly, since I replace ether with excessively disintegrated matter, and he considers the particles of ponderable matter to consist of aggregates of ethereal substance. An ether whose condensation yields particled matter answers all the requirements of unity of substance.

As the subject is under discussion, there are some further points in the motor relations of particles which it may be well to indicate. It is highly improbable that the molecules of matter, even if it be in the state of a rare gas, wander at will, constantly changing their relations of position to other molecules. More probably there is very little independent change of place, each molecule being usually held as a close prisoner in a nest of surrounding molecules. The grouping of molecules may be changed by the action of external agencies, but a new molecular equilibrium tends to be quickly established. Such seems the general tendency of nature. If some of the molecules in a mass of substance have an independent motion, friction soon disseminates that motion, and brings them into harmonious conformity with their fellows. This we know to be the case with all moving masses of matter. Their independent motion is gradually overcome by friction, and their motion brought into accordance with that of surrounding masses. The same principle applies to molecules. Friction, or molecular impact, its equivalent, must quickly reduce their discordant movements, and bring all the molecules of a mass into harmonious motor relations.

Molecules are related to their fellows in three distinct methods, those of the solid, the liquid, and the gas. We can only conjecture the character of these relations. In the solid there is perhaps no impact of molecules under normal conditions. Each molecule may lie in the centre of a nest of attractions, within which it describes a vibratory movement, without coming into contact with any of the similarly moving molecules that surround it. In the gas attraction also acts, but not vigorously enough to restrain the moving molecule, and cause vibration. Here, then, impact is incessant. Yet the molecule can seldom escape from its nest. It is driven backwards on all sides, and held captive within a contracted space. A certain harmony must arise between the motions of these gas molecules under conditions of equalised temperature, which must tend to produce an equal resistance to escape in every direction, and to confine each within a fixed space in relation to those surrounding. Such is not the case when in one gas a volume of a different gas is set free. The molecules, moving with different speeds, cannot harmonise in their impacts. The molecules of the second gas find open spaces in the net of the first, and rapidly disseminate themselves. But the probability continues that in every homogeneous gas, at a fixed temperature, there is little or no free excursion of molecules. In the liquid there are also probably harmonious relations of molecular motion. The character of this motion we do not know. It is possibly a rotation around general centres of gravity. However that be, each molecule must, under homogeneous conditions, move within fixed limits.

If such be the case, each molecule of a homogeneous mass occupies a fixed field, from which it cannot of itself escape, and whose boundaries it cannot change. These boundaries are absolutely fixed by two energies. One of these is the momentum of the molecule, by which it drives back those surrounding it. The other is the pressure bearing upon the mass of which it forms a part. This pressure is usually very great, so that the space occupied by each molecule is very minute, and its change of direction is necessarily very frequent. The pressure constitutes a tension, to which every molecule is subjected, and each has a normal rate of vibration, in accordance with this tension. Of course the weight of the molecule is a constant element in determining its vibratory pitch, which is therefore dependent upon the fixed element of weight and the varying element of pressure.

Such may be the condition of equilibrium of all material molecules, whatever their state of aggregation, namely, the confinement of each molecule within a limited field, within which it incessantly moves, but from which it cannot escape. And to this condition of absolute localisation of every particle all matter tends to come, according to the theory of dissipation of energy. But as nature now exists there are opposing influences which constantly overcome the tendency to localisation. One of these is the attraction of gravitation, which causes independent motion both in masses and in molecules. The other is the heterogeneity of momentum of molecules, or what is usually known as inequality of temperature.

So far as the first of these is concerned, matter is now nearly in equilibrium. The spheres are yet contracting, under the influence of gravity, but this contraction is so gradual as not to materially affect the relations of molecules. Their mutual localisation is but slightly disturbed by this cause. The inequality of temperature is a more vigorous disturbing cause. To this are chiefly due those transfers of energy through space, and of matter through other matter to which all life and activity must be ascribed. The inequality here referred to, as mentioned in my former paper, is not of absolute heat contents, but of temperature, which is a very different thing, since density affects the heat-containing powers of matter, and two masses of different density may be equal in temperature while very unlike in heat contents.

The accepted view of radiation is that there is everywhere an unceasing outward transfer of molecular motion, that each molecule constantly yields and constantly receives radiant heat, changing in temperature when these transfers are unequal, but not when they are equal. This seems to me an incorrect view of the subject. If two masses of matter of equal temperature be in contact there can be no radiation at all, instead of a double radiation. For no molecule can transfer any of its energy to others. If two molecules of equal momentum come into contact, neither can lose nor gain momentum. The momentum of each remains the same after as before the contact, and there cannot properly be said to have been a mutual transfer of energies. The only change that takes place is a change of direction of motion, and in this respect the change in the one case balances that in the other.

Thus properly we can speak of a transfer of motor energy only when the momentums of the molecules differ, and in this case the transfer is from the most to the least vigorous only. Heat is yielded outwardly, but not cold. This transfer is continually taking place, since the temperature of matter is very far from a state of equilibrium. The transfer takes place in two methods. One of these is through direct collision. The other is through vibratory impulse. We must consider these in succession.

Collision constantly takes place between the molecules of gases. It takes place also in solids and liquids when by any cause their molecular equilibrium is disturbed. The result of a transfer of energy in this manner is what we may call an impact radiation. Motion cannot lose or gain speed or change in direction except through the influence of counteracting energies. Thus every impact radiation must run directly outward until overcome by opposing energies of equal vigour. It is transferred from particle to particle, its speed changing in accordance with the weight of the particles, but its momentum continuing unchanged. Such impulses are constantly travelling in all directions. They are very frequently checked by equal opposite impulses, and thus become local motion of molecules. This is the ever-acting equilibriating tendency.

The other mode of molecular transfer is that supposed to be through exchange of vibrations—the radiation of light and heat. This transfer presents two relations. One is that of speed. This depends not on the speed of the motion, as in impact transfer, but on the tension of the conveying particles. As their tension increases, the radiant wave is conveyed more rapidly. As it diminishes, the wave travels more slowly. It is quite possible, indeed, that the waves of light may move with a different speed in interastral space from their known rapidity in the ether of the solar system, since ether may not be everywhere in the same state of tension. If so, certain astronomical conceptions would be affected. This equal speed of radiant transfer, whatever the rapidity of the vibration, indicates that radiance differs essentially from impact transfer. In fact, there is no special necessity in their character that transverse vibrations should be transferred. They may cease with any particle, and continue to exist as continuous vibration of that particle, or the energy of the vibration be yielded to it as direct motion. If in this case the particle move more vigorously than those surrounding, the vibratory transfer will be replaced by impact transfer.

This cessation of radiant transfer is constantly taking place. Every wave of light and heat that comes to the earth's surface is partly converted into local heat, partly transmitted through transparent substances and partly repelled from the surfaces of substances. Thus radiant transfer seems to be rather an accident than a necessity of matter, since the energy thus transferred can be immediately exchanged into local energy, without the agency of equal opposing energy, as in impact transfer. Whether the wave shall travel onwards, be absorbed, or be repelled, appears to depend on the tension of the substance which it affects. Each molecule of every mass has its normal pitch of vibration, in accordance with its weight and tension. If the radiant vibration be in complete accord with that pitch it will be retained as local heat vibration. If in imperfect accord it will be partly held. If discordant it will be transferred or repelled. In the latter case it probably follows the easiest channel. Although the direction of the ray is readily changed, yet probably it has a special vigour of movement in the direct channel. Other things being equal, it would follow the direct in preference to the reflected course. Therefore in cases of reflection there must be a resistance in the molecules of the reflecting substance which makes it easier for the wave to change its direction than to force itself on these molecules. This change of direction in the wave, however, is not a change in the direction of motion. The vibration continues in its original plane. It can only be changed from this plane by special influences within transparent substances, in which the wave vibrations, while acting upon the molecules of the substance, are in some way distorted by their interaction with the normal molecular motions.

There are two other methods of transfer of molecular motion to which brief allusion may be made. One of these is the electric transfer. The character of this we do not know, but we have reason to believe that it is vibratory, and that it bears certain analogies to light vibration. The other method is heat conduction. This is a transfer of energy by exchange of normal vibrations. It takes the place in solids of the impact transfer in gases. The molecule of the solid, when possessed of excess motive energy, cannot yield it to others by impact, and must therefore do so by a drag upon these others through the ties of attraction. This is the slowest of all modes of transfer of energy. For its proper action it is necessary that the substance should be homogeneous, and the vibrations of its molecules normal. The instant the tension changes, either by connection of unlike substances or a condensing twist in a homogeneous substance, the mode of transfer changes. The heat vibration of the molecule is offered to another of different pitch, which refuses to receive it as normal vibration, and at once the rapid electric transfer manifests itself. Normal heat vibration is thus converted into thermoelectricity.

Their brief review may help to give some idea of the relations between molecules. In their state of normal equilibrium, which they seek to regain after every excursion, they possess no independence of movement, but are rigidly confined within fixed limits. They may change place in common with all the molecules of the mass to which they belong, but not independently. Vigorous disturbing influences may break up the molecular grouping, but immediately a new stable grouping is assumed. The incessant molecular disturbances which occur do not usually cause a change of grouping. These consist of vibratory transmissions of energy, and of transfers of motion through impact of molecules, and their effect is but the production of momentary variations in the direction and vigour of the motion of the affected molecule. To the influences of this character above mentioned may be added those of the vibrations of sound, of magnetic energy, and of chemical affinity. The latter alone produces any marked variations of molecular grouping.

Philadelphia, U.S. CHARLES MORRIS

On the Morphology of the Pitcher of "Cephalotus follicularis"

I OBSERVE that the last sentence but one of my brief notice of Cephalotus, which appeared in NATURE last week, is calculated to convey an erroneous impression. The lid *g* of Fig. 1 is seen to be a conical structure with a relatively broad base and a narrower indented apex. In the matured pitcher the free portion of the lid is much broader than its more contracted base; and the developed and involuted margin referred to extends round the mouth of the pitcher *until it reaches that base, but does not cross it*, as by an oversight on my part my words imply.

Fallowfield, Manchester, June 8 W. C. WILLIAMSON

A Large Meteor

THE meteor seen by Mr. Hall of Shoreham (NATURE, vol. xxviii. p. 126) was also observed by Mr. James Cullen of the Stonyhurst Observatory. Its path, as seen from here, was from S.E. by E. to N.E. by E. (true), traversing an arc of about 70°. Its altitude was not more than from 12° to 15° above the horizon. It travelled exceedingly slowly, was visible for about 20 seconds, and was first seen at 10.30 p.m. G.M.T. Its size was that of the full moon, white in colour, and with a tail 10° to 12° in length. It burst into a shower of small pieces before it disappeared, presenting exactly the appearance described by your correspondent.

Owing to the twilight and to the haze which hung about the horizon, its position could not be referred to the stars, the only star visible being α Aquilæ, near which the meteor passed. From the compass bearings and altitude given above its approximate path was from Æ 18h. 50m., $\delta - 2°$, to Æ 22h. 35m., $\delta + 25°$.

Stonyhurst Observatory S. J. PERRY

YOUR correspondent, A. Hall, in your issue of June 7, records the appearance of a large meteor seen by him at Shoreham, Kent, on Sunday evening, June 3, at 10.40. I recorded the same meteor in the *Newcastle Daily Journal* as follows:—

"*An Enormous Meteor*.—Mr. Barkas informs us that on Sunday evening, June 3, at 10.40, an enormous meteor of great brilliancy moved slowly across the heavens from south to north, at an elevation of 30 degrees, and nearly horizontally. The colour was bright white, the apparent length 5 degrees; it had the form of an artist's brush; and the handle broke into many fragments. The head suddenly disappeared. This meteor was seen at Newcastle, Wreckington, and Cullercoats, and it would be interesting to know in what position it was observed at points far south of Northumberland."

Your correspondent does not say whether he saw it towards the south or north, nor does he state its elevation above the horizon. It would be interesting to know its apparent elevation at places north of Kent and south of Northumberland.

Newcastle-on-Tyne, June 8 T. P. BARKAS

Intelligence in Animals

IN NATURE (vol. xxviii. p. 82) is a letter headed "Intelligence in a Dog," which certainly shows that a power of reflection is sometimes possessed by the canine species far beyond what one ordinarily observes in them. Perhaps the following anecdote will interest some of your readers, in which it will be seen that the common crow of India exhibits (occasionally at least) an equal amount of a quality superior to what is usually styled *instinct* in animals.

In the summer of 1878, when I and a friend were travelling in the Himalayas, we marched from Dharmsala to Simla, passing through the native states of Mundi, Suket, Bilaspur, and Erki. One day, when we were about half way between Suket and Bilaspur, we rested two or three hours under the shadow of a rock whence there issued a spring of water most welcome to us thirsty and somewhat weary travellers. We drank our fill and threw ourselves down upon the ground. After we had been there a short time an old crow and its half-grown young one came also to slake their thirst. I happened to have a small piece of a stale chuppati (or unleavened bread which the natives eat) in my pocket, and I threw it to them; the old bird examined it, turned it over, and then called her young one to come and partake of it. The latter did his best to obey his parent, but the morsel was so hard and dry he could not manage to eat it, and said so in his own bird language. The old bird then as plainly replied "try again," which he did most obediently, but with no better success. The old bird then took up the rejected piece and deliberately placed it in one of the little streams formed by the water of the spring (perhaps about six feet beneath where I was lying); she then hopped off, followed by her young one, and here comes the most curious part of the story: in about a quarter of an hour or so both birds returned to this spot, the old one with her beak pointed to the piece of chuppati, which by that time had been rendered soft by the action of the water, and by signs and sounds seemed plainly to tell her young one, "There now, the food is soft; eat it, and no more nonsense." This the young bird immediately did.

Copenhagen, June 8 COSMOPOLITAN

MY big black Newfoundland retriever, "Faust," has a chivalrous habit of taking smaller and weaker dogs under his protection, and about two years ago he constituted himself champion of a wretched little thoroughbred mongrel whom we called the "Pauper," because it lived on charity in the garden opposite our house. "Faust" goes out marketing with the housekeeper, and as he has a passion for bread the baker's children always give him a stale roll. One day, for fun, they gave him two, which he picked up with some difficulty and then left the shop, followed by some of the children, one a lad of sixteen. "Faust" walked along the side of the garden railing till he met his pauper friend, to whom he gave one roll, and then ate the other himself, waving his tail vigorously in evident satisfaction. A neighbour of ours has a kitchen cat who was taken in out of charity himself, and who has several times brought in famishing friends for a meal. NELLIE MACLAGAN

Edinburgh, June 11

EASTERN ASIA AT THE FISHERIES EXHIBITION

THE sections of the Fisheries Exhibition devoted to China, Japan, and the British settlements and protected native states in the Malay Peninsula, are in some respects disappointing. The interest and beauty of the Chinese section are indeed unsurpassed; but the other